Mobile Multimedia Terminal For DVB-T and Large and Small Cell Communication

U.S. Patent Application of:

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Mobile Multimedia Teminal for DVB-T

And

Large and Small Cell Communication

Field of the Invention

This invention relates to multimedia terminals and, more particularly, to interactive multimedia terminals using DVB in a mobile environment.

Background of the Invention

The explosion of wireless data communication has been fueled by advances in semiconductor technology and software. These advances have allowed audio and data signals to be transmitted over digital networks.

Digital and mixed signal systems offer many advantages over old-fashioned analog systems. One important advantage is the ability of digital systems to transmit and receive more information at higher rates. Whereas analog systems are limited to transmitting audio and video at a rate of 64 Kbps, digital systems can compress such transmissions to transmit eight times as much information at the same rate. Moreover, faster processors have allowed digital systems to transmit bits at ever increasing rates. By taking advantage of the compression routines and faster processors to transmit information more accurately and at higher rates, significant savings have been realized in both switching capacity and ongoing line costs.

Additional advantages have been realized through the use of multiple access techniques such as Time Division Multiple Access ("TDMA") and Code Division Multiple Access ("CDMA"). These techniques allow for multiple users to access a single bandwidth. They also allow for audio and data signals

transmitted by a single user to be intermingled. These techniques make better use of scarce airwave space.

A recent development in the wireless information revolution has been the transmission of digital video signals over the airwaves, for example, using DVB-T. A similar development is occurring in the RF band, as efforts are being made to add video capability to cellular telephones, fax machines and computers. Before quality video capability can be added to these machines, however, a problem arising from bandwidth limitation must be overcome. Because these machines operate on frequencies between 900 and 1900 Mhz, the bandwidth is not wide enough to transmit the enormous amount of video and audio information that is required for quality motion pictures.

Digital television provides more channels at a higher quality than is currently available with analog broadcasts. One analog channel provides the bandwidth capacity for one high-definition (HDTV) digital broadcast or several standard definition (SDTV) digital broadcasts. Digital television is scalable between these two extremes. Therefore, digital broadcasters can make a trade-off between vastly improved image and sound quality and an increased number of programming choices.

Digital television is deliverable to moving receivers. Currently, analog television reception is non-existent or severally limited in moving receivers. However, digital receivers allow for clear reception in cars, buses, trains, and in handheld television sets such as the Sony Watchman™.

Most of the equipment used to create, edit, and distribute television programs is now digital. The analog reception of a television signal, via cable, aerial, or satellite, is the end result of a long chain of events, most of which have taken place in the digital domain. For example, in delivering a new broadcast, the field reporter uses digital satellite news gathering equipment to

uplink her report to a programming center. The material is digitally received, decoded, and compiled with live program feeds in a studio. The broadcast is then sent digitally around the world to professional receivers. Finally, the broadcast is converted to an analog signal and sent to the end viewer.

An intelligent TV can receive communication services by connecting a TV to a value added network (VAN). The intelligent TV includes an information signal processing unit for receiving information communication data (hereinafter, "information data") when the intelligent TV is connected to the VAN, and for generating information RGB signals, and switching control signals in order to display the information data on a screen. The intelligent TV selects and displays on the screen one of the information data signals processed in the information signal processing unit and a TV RGB signal processed in a TV signal processing unit, in accordance with the switching control signal output from the information signal processing unit. Intelligent TV makes it possible to view, through a TV screen, several communication services, such as stock quotes, news services, weather reports, and TV program lists, being transmitted through the VANs. Therefore, it has an advantage that persons who are not familiar with the usage of a computer can easily receive communication services.

Even though intelligent TV has the advantage of receiving communication services through the TV screen, it cannot display multiple signals at the same time. Information signals for displaying information data on a screen, a TV signal, a Picture-In-Picture (PIP) signal for enabling two screens to be viewed simultaneously, and a TV on-screen-display (OSD) signal must be displayed one at a time. Therefore, signals are displayed according to a predetermined priority. For example, an information signal is displayed

preferentially over a TV signal, a PIP signal is displayed preferentially over an information signal, and a TV OSD signal is displayed preferentially over a PIP signal.

Current information delivery services described above lack many features that would enhance their usability and desirability by the public. As mentioned, the intelligent TV lacks an ability to display multiple signals simultaneously. In addition, an online connection of two delivery services with one of the services being, for example, an interactive application, is not available. Current technologies are dependent on stationary receivers. Since multiple signals cannot be integrated by the integrated receiver/decoder (or IRD), information delivery is dependent on the location or site.

New display technologies provide the possibility to build low power and high quality portable display devices. These devices are based on large full color flat panel displays or on virtual (helmet mount) displays. The common denominator for these kinds of displays is that they are digital and matrix type displays. Introduction of DVB-T enables, for the first time in TV broadcast history, the possibility of truly mobile reception of TV. In addition to conventional TV services, DVB-T provides access to broadcast data services. Integration of DVB-T with digital display unit, such as the flat panel or helmet mount displays described above, makes it possible to build fully digital TV receiver with studio quality picture.

Figure 3 depicts a block diagram of the current multimedia architecture. Currently, the digital set-top-box (STB) **302** and digital TV display **304** are separate. Furthermore, the STB 302 communication link is only of a single type. For example, the STB communications link is a hard interface such as coax-cable or POTS. Therefore, the typical digital TV 304 connected to an STB 302 offers no portability or mobility.

Laptop and notebook computers are now equipped with the means to connect to networks using a mobile (or wireless) link. Such connections usually utilize a modem and digital wireless transceiver built on a single card, *e.g.*, a PCMIA card. However, digital TV receivers have not been integrated into such devices. One reason for this lack of versatility is that digital TV receivers have high power consumption rates (relative to other laptop or notebook functions). Thus, the battery power of a laptop would be consumed rapidly. In addition, laptops, like STBs, are typically limited in their ability to communicate externally. For example, a serial port, parallel port and possibly a modem can be used to distribute information from a laptop. However, such devices do not switch between these links seamlessly. Further, such devices do not have the ability to take stock of their environment and dynamically switch to the most appropriate communication link.

<u>Summary of the Invention</u>

The disclosed embodiments provide a method and apparatus for providing an interactive mobile multimedia terminal. The mobile multimedia terminal (or MMT) allows for wideband data stream reception using a digital data broadcast receiver such as DVB-T. Interactivity is realized with built-in local or large cell size communications link. The local link could be WLAN or Bluetooth (a low-power RF transceiver). The large cell size communications link could be a mobile station link e.g., GSM, CDMA, TDMA, etc. A mobile station with a Bluetooth link can be used as an IP router or a portable base station for large cell size communication if no local connection point is found. The MMT integrates DVB-T reception, digital display, and communications links together to provide interactivity in a mobile environment. The MMT communications link with a mobile station enables it to act as an extended

display for the mobile station. The MMT can also act as a graphical interface for SMS messaging via the mobile station or manipulating other applications on the mobile station.

The disclosed embodiments can provide several advantages. For example, the MMT is a single device that can be used in a portable or mobile environment. The MMT is configured with different wireless links, enabling it to adapt seamlessly and dynamically to its communications environment by switching between different communications interfaces, protocols, or links. For another example, the MMT can be used to receive and display (or broadcast) different kind of data. Such data can include, for example, digital content *e.g.*, MP3 files, e-books, or newspapers, e-commerce data, or broadcast TV. For another example, the timing and synchronization manager can be used to save power by controlling the digital receiver of the MMT.

Brief Description of the Drawings

The disclosed inventions will be described with reference to the accompanying drawings, which show important sample embodiments of the invention and which are incorporated in the specification hereof by reference, wherein:

Figure 1 depicts the presently preferred embodiment of the mobile multimedia terminal;

Figure 2 depicts the presently preferred embodiment of a MMT and its corresponding communications environment;

Figure 3 depicts a block diagram of the current multimedia architecture; and

Figure 4 depicts a block diagram of a mobile station **400** that can act as an IP router or portable base station to the MMT 100.

Detailed Description of the Preferred Embodiments

The numerous innovative teachings of the present application will be described with particular reference to the presently preferred embodiment. However, it should be understood that this class of embodiments provides only a few examples of the many advantageous uses of the innovative teachings herein. In general, statements made in the specification of the present application do not necessarily delimit any of the various claimed inventions. Moreover, some statements may apply to some inventive features but not to others.

Figure 1 depicts the presently preferred embodiment of the mobile multimedia terminal (or MMT). The MMT provides an interactive, mobile environment. In the presently preferred embodiment, a DVB-T receiver **102** is controlled by a CPU **104**. The DVB-T receiver 102 is capable of receiving digital TV broadcasts according to the DVB-T standard. DVB-S (satellite) and DVB-C (cable) broadcasts are also standardized and may be used. The DVB-T standard specifies a broadband channel, preferably in the VHF frequency range, that carries a digital data stream. In addition to TV broadcasts, channels in the DVB-T spectrum can be used to transmit data intended for receipt by specific users. Such data is generally encrypted for privacy. In this manner, DVB-T (or DVB-S or DVB-C) can be used for data transmission which requires a wideband downstream channel (from the source to the requestor). In the presently preferred embodiment, the MMT **100** is the requestor.

A media decoder **106** is controlled by the CPU **104** and used to decode the received DVB-T broadcast. The DVB-T broadcast standard uses MPEG-2 encoding. Therefore, in the presently preferred embodiment, the media decoder 106 is an MPEG-2 decoder. However, other forms of streaming video can and do use alternate protocols to transmit digital data. The media decoder 106

selected should be designed to match and decode the transmission protocol used by the digital data source.

A display interface **108** receives the decoded broadcast from the media decoder 106. The display interface 108 is designed to optimize the display of data to a user of the MMT 100. For example, the digital data received can be in the form of full motion video or it can be a graphic of some kind. The differing formats require differing modes to be optimally displayed. The display interface 108 acts as a video integrator. For example, the display interface can place a graphics overlay onto full motion video, manipulate the display of full motion video into a certain part of a display, or crop some video or graphics to show only their essential or moving parts on a display. The output of the display interface 108 drives a display **110** for the MMT 100.

In addition to processing a digital broadcast signal, the MMT 100 of the presently preferred embodiment is capable of transmitting information. Such information can include requests for information, data to be downloaded via digital broadcast, phone identification data, or regular voice and data communications over a mobile station (such as a mobile phone). In the presently preferred embodiment, the MMT 100 is equipped with a low-power radio frequency (LPRF) *e.g.*, Bluetooth, transceiver **112**. A transceiver configured according to the Bluetooth standard is capable of short range (approximately 10 meters) radio communication to a local transceiver. The local transceiver can be connected to a LAN, PSTN, or a low or high power wireless network. In addition to a LPRF link, the MMT 100 of the presently preferred embodiment can be configured with a Wireless-LAN **114** or cellular transceiver **116**. The cellular transceiver can be, for example, a GSM, TDMA, CDMA, AMPS, or other standard or proprietary communications protocol. The CPU controller 104 of the MMT 100 is configured to select the mode of

communication between transceivers 112, 114, and 116 dynamically. The CPU 104 can select the appropriate communications link according to the current communications environment. For example, if a Bluetooth transceiver is detected, data can be exchanged using the Bluetooth transceiver 112 without the need for acquiring a channel on a cellular link. However, if voice data is to be transmitted, a cellular link would be desirable. Thus the CPU 104 would select the cellular transceiver 106 for transmission duties.

The LPRF link 112 of the MMT 100 can be used in conjunction with an external mobile station. The external mobile station can act as a portable (close range) base station. The external mobile station can also act as an IP router for web browsing and other network activities.

The DVB-T receiver 102 of the MMT 100 is activated or deactivated by the CPU 104. The DVB-T receiver 102 can be activated at user request. That is, when the user wishes to receive broadcast data or is expecting to receive broadcast data. The CPU 104 can also monitor the environment for service information and activate the DVB-T receiver 102 if conditions warrant it. For example, if services the user wishes to receive are detected, the CPU 104 can activate the DVB-T receiver 102. As another example, the CPU 104 can activate the DVB-T receiver 102 if and when it needs to, in order to impart important or timely data to the user, *e.g.*, weather or news data.

In the presently preferred embodiment, the DVB-T receiver 102 is equipped with a timing element **118** enabling it to remain synchronous with the digital broadcast facility. This timer 118 makes it possible to switch on the receiver and pick up the selected data packets days after the last system synchronization. The timer 118 allows the CPU 104 to control activation of the DVB-T receiver 102 also enables power savings. For example, if video functionality is not currently in use, that is, digital broadcasts are not being or

do not need to be received, the DVB-T receiver 102 is switched off by the CPU 104 Such a situation can occur when, for example, the MMT is web browsing over a communications link 112, 114, or 116.

Figure 2 depicts the presently preferred embodiment of a MMT 100 and its corresponding communications environment **200**. Media is provided by a service provider **202**. Media can include, for example, data services, decryption keys for smart cards, digital TV, digital audio, or other digital data. The media can be provided on the request by user or under a "broadcast" principle. In the presently preferred embodiment specific requests for data are handled via a mobile station **204** equipped with an LPRF transceiver. The requests are transmitted via an LPRF link from the MMT 100 to the mobile station 204. The mobile station 204 relays the request via a wireless operator **206**. The service provider 202 capable of providing the requested data receives the request from the wireless operator 206. The media content is routed from the service provider 202, via DVB-scrambling **210**, to a DVB Network operator **212**. The DVB Network operator 212 multiplexes the media content with free to air TV Services **214** and transports the data over a DVB broadcast channel **208**.

At the MMT 100, the DVB-T transmission is received by the DVB-T receiver 102. A front end receiver **216** in the DVB-T receiver 102 receives the transmission, acting as the over-the-air interface of the receiver 102. Data is transmitted to a descrambler **218** with a smart card **220**. The descrambler 218 is optional in the presently preferred embodiment. The decrypted/descrambled data is then forwarded to a demultiplexer **222**.

The front end 216, descrambler 218, smart card 220, and demultiplexer 222 consume a majority of the power used by the DVB receiver 102. Data for

the demultiplexer 222 is routed to the media decoder 106. Alternatively, the data can be routed to buffer or storage memory **224** or an optional memory card **226**. Storing the data instead of decoding and displaying it is dependent on the set up and usage of the DVB-T receiver 102. For example, by storing data into memory, it is possible to display one data stream while receiving another. In the presently preferred embodiment, the timing and synchronization manager 118 controls the front end 216, descrambler 218, smart card 220, and demultiplexer 222. The timing and synchronization manager 118 activates these receiver components only when needed or upon user request. The CPU 104 of the MMT 100 controls all of the components of the MMT. The CPU 104 is responsible for reading the service information and determining the communication environment of the MMT 100. The CPU 104 is used to configure the timing and synchronization manager 118.

Content to be shown on the display 110 of the MMT 100 can originate either from CPU 104 via memory 224 or 226 or from media decoder 106. The display of the MMT 100 can be, for example, a flat panel TFT display or a virtual display such as a head mounted LCOS 3D display. Display data is processed by the display interface 108 of the MMT. This interface 108 performs the needed operations of scaling, zooming, frame rate conversions, filtering, in order to appropriately display the data on the display 110 of the MMT 100. The display interface 108 can be configured to optimally display data depending on its type and the type of display 110 to be utilized.

Digital content can also include audio signals. Such content can be presented through the audio output **230** of the MMT 100. The audio output 230 of the MMT can be, *e.g.*, speakers.

The MMT 100 can be configured to communicate in a variety of ways. For example, an LPRF link 112 can be used to communicate with a mobile

station acting as a portable base station or IP router. For another example, in a home gateway environment, the MMT 100 can act as a node in a Wireless LAN using a WLAN transceiver 114.

Figure 4 depicts a block diagram of a mobile station **400** that can act as an IP router or portable base station to the MMT 100. The mobile station 400 includes, in this example:

A control head **402** containing an audio interface, i.e. a speaker **404** and microphone **406**.The control head 402 generally includes a display assembly **408** allowing a user to see dialed digits, stored information, messages, calling status information, including signal strength, etc. The control head generally includes a keypad **410**, or other user control device, allowing a user to dial numbers, answer incoming calls, enter stored information, and perform other mobile station functions. The control head also has a controller unit **434** that interfaces with a logic control assembly **418** responsible, from the control unit perspective, for receiving commands from the keypad 410 or other control devices, and providing status information, alerts, and other information to the display assembly 408;

A transceiver unit **412** containing a transmitter unit **414**, a receiver unit **416**, and the logic control assembly 418. The transmitter unit 414 converts low-level audio signals from the microphone 406 to digital coding using a codec (a data coder/decoder) **420**. The digitally encoded audio is represented by modulated shifts, for example, in the frequency domain, using a shift key modulator/demodulator **422**. Other codes transmission utilized by the logic control assembly 418, such as station parameters and control information, may also be encoded for transmission. The modulated signal is then amplified **424** and transmitted via an antenna assembly **426**;

The antenna assembly 426 contains a TR (transmitter/receiver) switch **436** to prevent simultaneous reception and transmission of a signal by the mobile station 400. The transceiver unit 412 is connected to the antenna assembly 426 through the TR switch 436. The antenna assembly contains at least one antenna **438**;

The receiver unit 416 receives a transmitted signal via the antenna assembly 426. The signal is amplified 424 and demodulated 422. If the signal is an audio signal, it is decoded using the codec 420. The audio signal is then reproduced by the speaker 404. Other signals are handled by the logic control assembly 418 after demodulation 422; and

A logic control assembly 418 usually containing an application specific integrated circuit (or ASIC) combining many functions, such as a general purpose microprocessor, digital signal processor, and other functions, into one integrated circuit. The logic control assembly 418 coordinates the overall operation of the transmitter and receiver using control messages. The various disclosed embodiments make use of the logic control assembly to control scanning and evaluation of other base stations. Generally, the logic control assembly operates from a program that is stored in flash memory **428** of the mobile station. Flash memory 428 allows upgrading of operating software, software correction or addition of new features. Flash memory 428 is also used to hold user information such as speed dialing names and stored numbers.

In addition to flash memory 428, the mobile station will typically contain read only memory (ROM) **430** for storing information that should not change, such as startup procedures, and random access memory (RAM) **432** to hold temporary information such as channel number and system identifier.

In the presently preferred embodiment, the mobile station also includes an LPRF transceiver 112, *e.g.*, Bluetooth, for communication with the MMT 100.

Modifications and Variations

As will be recognized by those skilled in the art, the innovative concepts described in the present application can be modified and varied over a tremendous range of applications, and accordingly the scope of patented subject matter is not limited by any of the specific exemplary teachings given.

For example, the digital receiver is described as a DVB-T receiver. However, the digital data received could be in any of a variety of digital formats, frequencies, protocols, etc. The digital receiver used should be configured to receive the types of data expected. Moreover, the digital receiver could be configured to receive digital information in a variety of formats or receive analog *e.g.*, NTSC or PAL, and digital broadcasts.

For another example, the presently preferred embodiment is described as having only one digital receiver. However, differing embodiments of the MMT may be configured with multiple digital receivers. The use of more than one digital receiver can serve to increase the robustness of the data received in digital broadcast.

For another example, the presently preferred embodiment is described as operating over differing communications links, one at a time. However, it is possible that several of the communications links, *e.g.*, LPRF, WLAN, and/or a wireless mobile station link can be operated at once to send and receive information to multiple places simultaneously.

For another example, while not stated explicitly in the presently preferred embodiment, it is possible to integrate a mobile station into the MMT. An

integrated MMT/mobile station would allow the MMT to function as its own IP router or portable base station.

For another example, digital broadcast of data is anticipated in the presently preferred embodiment. However, it is possible that third generation (3G) or greater cellular networks will have the capacity to deliver TV reception and broadband data transmission. The MMT can be equipped with a different or alternate receiver which is configured to receive such digital data.